GEOGRAPHIC SCHOOL BULLETINS

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VOLUME 37, NUMBER 21, MARCH 9, 1959 . . . *To Know This World, Its Life*

JERRY WALLER

STRONG FINNISH FISHERMEN drag a mile-long net, heavy with herring, from under the ice of the Baltic Sea. A single haul requires four hours of steady, rhythmic work.

► Harnessing Africa's Zambezi River

► *Monitor* vs. *Merrimac*

► 'Silent Sound' Works for You

► Enduring, Industrious Finland

UMI

and modern technology won another battle with Africa.

Stopped in its course, the water now inches up the arched wall of the dam. It spreads to create a lake which will eventually cover 1,250,000 acres. The lake will have more than four times the capacity of Hoover Dam's Lake Mead, one of the largest man-made reservoirs in the world.

The first flow of electricity is expected next year. When the dam is finished in 1971, six generators will supply 90 per cent of the power needs of the Central African Federation.

The great, gray-green Zambezi River, fourth longest in Africa, rises principally in Northern Rhodesian marshes some 5,000 feet above sea level. Some headstreams flow from Portuguese-controlled Angola. Draining a 513,500-square-mile area, it threads a 1,600-mile course along the border of Northern and Southern Rhodesia, through Portuguese Mozambique, and into the Indian Ocean. Excluding the new spans at Kariba Dam, only three bridges cross the Zambezi.

W. ROBERT MOORE, NATIONAL GEOGRAPHIC STAFF

ASBESTOS MINERS break rock to recover asbestos at Shabani, Southern Rhodesia. New dam will supply power to such mines.

Harnessing the Zambezi will make possible development of heavy industry in Southern Rhodesia where sizable deposits of minerals are worked. The country is blessed with some of the purest asbestos in the world and ranks third in asbestos production.

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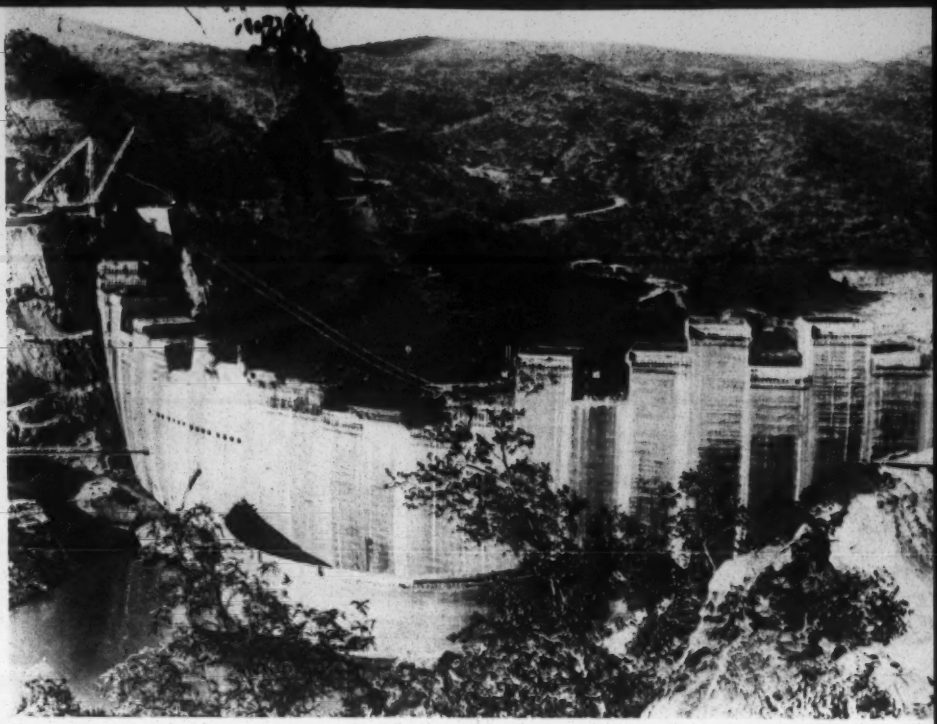

BRITISH INFORMATION SERVICE

Taming the Zambezi's Torrent

THE GREAT SNAKE OF THE ZAMBEZI, most powerful god of the Tonga tribe, failed. The white man's dam rose in Kariba Gorge. His concrete (above) holds back the raging waters. He has tamed the mighty Zambezi River.

The 50,000 Tonga people, who had grown their maize and tended their goats and cattle for centuries along the river, headed for strange uplands. Since the artificial lake will cover their farms, the Federation of Rhodesia and Nyasaland paid for the property, met the moving bill, sunk wells for them, and built roads into the hills.

But the natives resisted the move; change comes hard to them. They live in grass huts. The women knock out four front teeth, smear themselves with red clay, and put sticks through their noses—customs dating from the days of slave raids when the least attractive women were safest.

The Tonga maintained they could not desert the river and its gods. Police quelled riots by young braves armed with spears and pointed sticks. Finally, with great ceremony, the Tonga took the water spirits along to the dry hills. But they awaited the day, certain it would come, when the white man's scheme would fail, and they would return to the river valley.

Twice it looked as if the Great Snake would reclaim the lands for the Tonga. In two successive years unprecedented floods smashed the white man's work. Natives assumed an "I told you so" attitude as stampeding water uprooted bridges and wrecked equipment. But late last year engineers plugged the last gaps in the dam,

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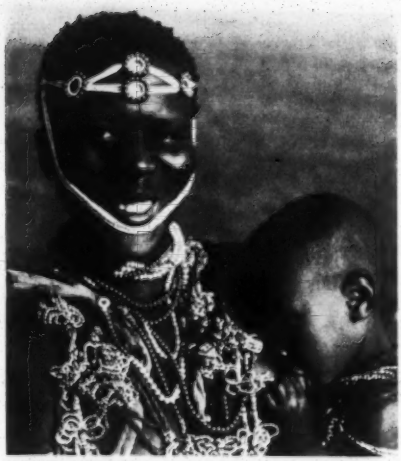

ELIZABETH ARMSTRONG

BLACK AFRICA remains primitive, aloof, sometimes hostile to Europeans. Yet Western governments have most of the say in the Zambezi region. Nyasaland riots reveal native dissatisfaction. Above, mother and child wear traditional costume. Below, seven-span donkey team plods a dirt road, hauling produce to market in Mozambique—Portuguese for four-and-a-half centuries.

Before the Zambezi flows into Mozambique, it passes plains rendered useless by lack of water and poisoned by the tsetse fly, carrier of the dread sleeping sickness that infects cattle and men.

When the river passes into the Portuguese Overseas Province of Mozambique its spelling changes to Zambeze, and its banks edge fields of maize. Midway between the border and the mouth, corn gives way to cotton. Downstream, rich sisal and sugar cane plantations line the banks. Gold, iron, and copper deposits are buried nearer the Rhodesian border, but they are undeveloped.

About 100 miles from the sea the Zambeze, through the Shire River, receives drainage from Lake Nyasa, 11th largest in the world. A 3,000-square-mile delta begins 40 miles downstream.

David Livingstone called the Zambezi "God's Highway." He dreamed of it as a turnpike to the interior where new life could be brought to a primitive people. Perhaps the Kariba Dam, with the power, food, industry, and navigation it promises, will bring life to his dream. L.B.

GILBERT GROSVENOR

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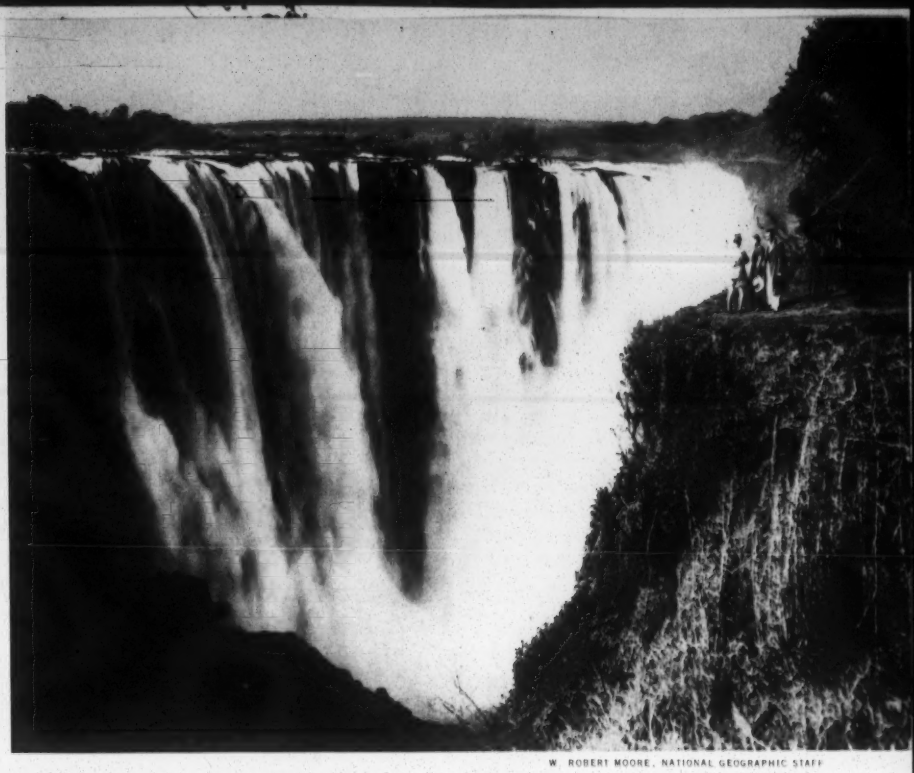

W. ROBERT MOORE, NATIONAL GEOGRAPHIC STAFF

Rhodesia also has deposits of high-grade chrome—an ingredient in stainless steel—as well as coal, lithium, copper, tin, iron, and gold. Northern Rhodesia's copperbelt will get first priority on Kariba power. The copperbelt is the largest source of the metal in the British Commonwealth.

Kariba Dam will control floods and irrigate a wide area of dry bush and plain. The reservoir is expected to yield 9,000 tons of fish a year.

As the water backs up, high spots of land become temporary islands. Monkeys, baboons, wart hogs, and deadly snakes are crowded ever closer together. Efforts to ferry them to safe land have been called "the biggest animal rescue operation since Noah's Ark."

On its long eastward course, the Zambezi meets primitive black men who wrest a meager living from the land, meanders among countless giraffes, hippos, and elephants, and leaps Victoria Falls (above). There are no cities and few towns on its banks. Much of the way, it flows through wild, uninhabited territory.

In the province of Barotseland, Northern Rhodesia, the tom-toms of the primitive Marozi people herald the river's annual floods. They load their belongings on cattle and retreat into the hills. When the torrent subsides, the herdsmen return to the plains.

As the river ambles leisurely along upstream from Livingstone, it provides a 300-mile highway for shallow draft barges carrying goods to hunters, traders, and government officials.

Just below Livingstone, some 750 miles from its source, the Zambezi crashes 350 feet into a narrow, mile-long chasm, belching clouds of mist. The natives called it Mosi-oa-Tunya—"Smoke That Thunders"—when David Livingstone discovered it in 1855. The explorer-missionary named it Victoria Falls for Queen Victoria.

When the dam is complete the Zambezi will supply power to Southern Rhodesia's two largest cities: Bulawayo and Salisbury, capital of the Federation.

In the last century fierce Matabele and Mashona natives had to be defeated before either city could be built. Now British busses honk donkeys out of the way. Modern stone buildings line the streets.

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TERRIFIC ENCOUNTER AT HAMPTON ROADS!

Ironclads Clash! Monitor Saves the Day!

NINETY-SEVEN YEARS AGO TODAY, it was spring in Virginia; quiet and bright. Buds swelled on the trees and gulls wheeled over Hampton Roads like eyebrows riding the air.

A gentle breeze rolled the mist blanket from the vast harbor—and revealed stark terror.

Among armadas of warships floated grim evidence of yesterday's battle, when the Confederate ironclad *Virginia,* better known by her earlier name, *Merrimac,* had sunk the North's finest ship, burned its second best, and caused consternation throughout the Union.

The dead vessels were proud, handsome ships of the line, bristling with guns. But they were wooden. Their shells couldn't penetrate the *Merrimac's* sloping iron sides; their timbers couldn't withstand her cannons and the sharp iron ram on her bow. *Merrimac* was squat and ugly, but triumphant.

U. S. NAVY 246

Yesterday she held dominion over every Federal ship she met. Today she steamed out to finish the job, to make matchsticks of the Union fleet, lift the blockade of the Confederacy, and, perhaps as important in the long run of the Civil War, impress observers from Britain and France. Both countries were tempted to support the South.

Under a cocky plume of black smoke, *Merrimac* left her anchorage and headed for the Union ship *Minnesota,* which was aground and helpless.

Beside the *Minnesota* lay a tiny ship that arrived the night before, just a flat deck with a round turret sticking up from the center—a "cheese box on a raft," a "tin can on a shingle," as the scoffers said.

She was the Union's ironclad, the *Monitor.* When her guns and the *Merrimac's* began their awful conversation they would launch a new era on the sea, an era that lasted until recently—the rule of the ironclad ship of battle.

The ships circled each other, letting fly with shot whenever a gun came to bear on the enemy. Neither could do more than dent the other's metal. After hours of slugging, they settled for a draw—which left the *Minnesota* and the rest of the Union fleet safe, Britain and France neutral, and every wooden warship in the world obsolete.

From these doughty ships evolved the battleship that ruled the oceans for decades, growing in size and power until it reached the strength of the USS *New Jersey,* left.

Now, aircraft, atomic weapons, missiles, and other advances in war have seemingly done to the battlewagon what the *Monitor* and *Merrimac* did to wooden ships. The last United States battleship in active service retired to moth balls last year. F.S.

THE AGE OF STEEL bettered plowshares as well as swords, this advertisement points out→

back in different strengths, depending on what they strike. Bone, muscle, healthy and diseased tissue have characteristic echoes that enable doctors to locate, for example, brain tumors. Once a tumor or small cancer is found, sound waves can be focused on it to destroy it by vibration.

The same echo principle makes "silent sound" useful in discovering flaws in metal castings, measuring thickness, and prospecting for oil under the earth.

In addition, the waves can be used to give off heat for special uses. In the picture below, "silent sound" from the cone at bottom bounces off a pane of glass into the dish-shaped reflector. Focused on the wad of cotton, the waves set it afire.

This heat, carefully controlled, has brought relief to sufferers from arthritis and other diseases. Researchers must be careful with this new tool, for the powerful waves can kill mice and insects, and no one yet knows all the safeguards needed for work on human beings.

One field in which it has proved successful and safe is dentistry. Now a dentist can drill your teeth without his machine ever touching them. A small tip,

WESTINGHOUSE ELECTRIC CO.

vibrating at extremely high speed, produces ultrasonic waves close to the tooth. Abrasive powder on the surface of the tooth bounces in rhythm to the sound waves, grinding a precise hole in the tooth. Since no heat forms, there is little or no pain, and no reason to fear the dentist.

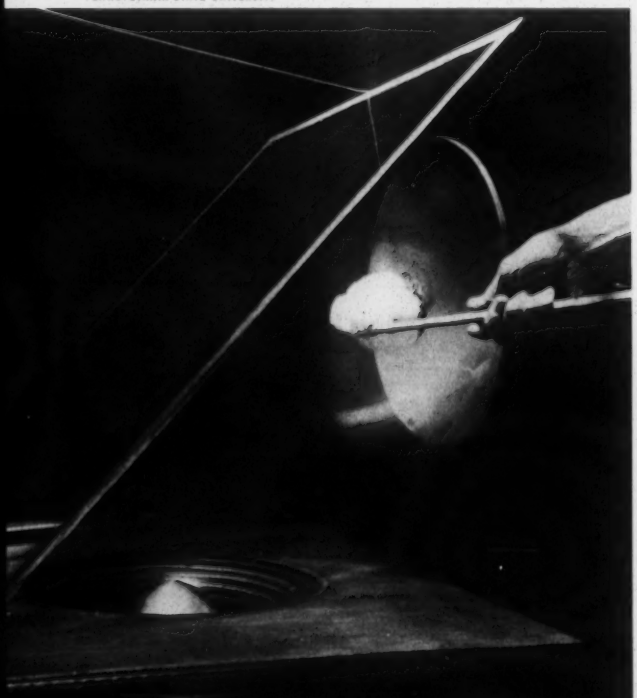
After years of experiment, these drill-less drills are moving out of the laboratory and into dentists' offices.

If ultrasound can make you feel better, it can also make you look better. Cosmetic makers use it to mix oil and water to produce cleansing creams.

For do-it-yourself addicts, ultrasound can take the stirring out of painting—the waves mix the paint so it stays mixed.

For centuries hungry men have thrown nets or lines into the water and hoped there were fish around. Now a fisherman can "see" beneath the surface by ultrasonics, and need never put over his net unless there are fish to be caught. F.S.

PENNSYLVANIA STATE UNIVERSITY



UMI

IT'S ALL VERY WELL to fly about in the dark, but how does the bat see where he's going? Why doesn't he fly into things? Because he "sees" with his ears. He constantly shrieks at sound frequencies above the range the human ear can hear. These cries echo back from any obstacle—even a wire or a thread—tell him where it is, and allow him to avoid it.

HAROLD E. EDGERTON

New Tasks for 'Silent Sound'

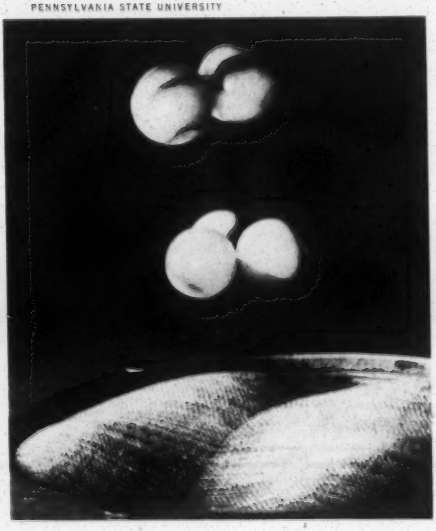
BY APPLYING THE SECRET of the bat, man has learned to do a multitude of jobs more quickly, easily, and cheaply. Almost every day, it seems, he learns a new use for "silent sound."

A seeming contradiction, "silent sound" means sound waves that pulse too fast for the human ear to record. All sound is formed by alternating waves of high and low pressure, similar to the spreading circles formed when a rock is thrown into a lake. Your ear reacts to these waves if they come faster than 16 per second and slower than 17,000 a second. Above that speed is the realm of ultrasonics.

Using such waves, man, like the bat, can locate things—enemy submarines, fat schools of fish. He cleans delicate instruments or a milk glass. He finds hidden flaws in metal parts. He gains new insight into his own body, locates diseased areas deep within his brain and kills them. He takes the soot out of factory smoke and dispels fog. Perhaps best of all he can drill teeth without heat and pain.

The sound waves are so strong they will hold marbles up in the air, as in the Pennsylvania State University experiment at left.

PENNSYLVANIA STATE UNIVERSITY



One promising field for using this strength is in cleaning. Already, ultrasound shakes impurities from surgeon's instruments faster and better than hand scrubbing. In experimental models of dish and clothes washers, ultrasonics does the work.

When sound waves of right frequency are beamed through a liquid, they cause the formation of millions of tiny bubbles against any surface inserted in it. These burst against the dirt, blasting it from even microscopic holes.

The picture below shows the waves cleaning a drinking glass in an experimental dishwasher. Clothes can be cleaned the same way.

Soon ultrasonics will make your life healthier. Already, they have probed deep within the human body to discover things that X-rays cannot. The waves bounce

on again. They reflect both Russia's attempt to dominate economic life and disapproval of Finland's internal politics. The Finns neither fawn nor quake. Their aim is to maintain friendly relations with their big eastern neighbor, while retaining their democratic tradition.

One of the first nations to grant women the right to vote, Finland also boasts the highest literacy rate in the world—99 per cent. Population concentrates in the south. Chief manufacturing center is Tampere, second largest city, 100 miles northwest of Helsinki, the port-capital.

Plans for industrialization of the north rely on its immense hydroelectric potential—one of the country's few natural resources. Recently-discovered iron ore, copper, and some rarer metals may replace the nickel mines handed over to the Russians in 1944.

The Finnish economy is based on wood. Vast forests, where cutting and annual growth is kept in balance, provide 80 per cent of her exports. In winter, logs are hauled by horse or tractor to waterways. In spring they float down a network of rivers and a labyrinth of lakes (below) to ports and factories.

Pine, fir, birch go out in the form of cellulose, pre-fabricated houses, paper, plywood, cardboard, beams, veneer, alcohol, and artificial silk. The United States is Finland's fourth largest customer.

Tourism is a growing industry. Skiing as late as May makes the rolling fells of Lapland a popular resort. This northern area, where 2,500 migratory Lapps tend their reindeer, tempts fisherman, hiker, and canoeist. Even the baths are an attraction.

No Finnish house—in remote countryside or city—is complete without its *sauna* in which the Finns take their famous steam baths, stimulating their blood circulation by beating themselves with whisks of leafy birch twigs.

All sports attract the exercise-conscious Finns, who have collected more Olympic medals than many larger nations. They excel particularly in track. Recognition of their prowess was implied in plans to hold the 1940 Olympic Games in Helsinki. But armies instead of athletes met that year. Twelve years later the Finns were able to make good their invitation, and the games were held. F.W.R.

See Also: *National Geographic*—August 1954, "North with Finland's Lapps" ($1); August 1947, "Scenes of Postwar Finland" ($1). *School Bulletins*—October 22, 1956, "Helsinki" (out of print); March 4, 1957, "Meet the Lapps" (10 cents). *Map*—Northern Europe ($1)

BARONESS ALICE STAEL VON HOLSTEIN

UMI

CARLETON MITCHELL

FINLAND Politics, Climate Tax Hardy People

BRIGHT SUNLIGHT lures customers to the market place of Helsinki, where sturdy farmers spread their wares and bargain over prices. But over Finland spreads a shadow—the might and ambitions of Russia.

Living beside the Iron Curtain, hard-working Finns continue their country's 900-year struggle for independence.

The only survivor of the Baltic states set up after World War I—Latvia, Lithuania, and Estonia have been swallowed by Russia—Finland is wedged between Sweden and the U.S.S.R.

Today it finds its political climate more demanding than the rigorous weather which blows from the Arctic Circle to blanket its forests with snow. The Russian winds blow hot and cold.

The swirl of war that began with the Russian invasion of 1939 has left Finland in a peculiar situation. Its largest customer is its giant neighbor, who demanded $300,000,000 in reparations after the war—in addition to a slice of Finnish land.

Now about the size of Montana, the country lost more than a tenth of her territory to Russia. A tenth of Finland's 4,500,000 population lived in this area, which held some 13 per cent of Finland's wealth. Rather than live under Communism, farmers left their homes to settle elsewhere in Finland. There were other, more tragic losses from the bitter war years—85,000 men killed, leaving 30,000 widows, and every 25th child an orphan.

When peace came to the decimated country, industrious Finland (the only nation in Europe to pay its debt to the United States after World War I) went to work to pay the heavy reparations. Men, women, and children pitched in, considering the debt a personal duty.

About a third of the goods demanded was timber and timber products—which heavily forested Finland could procure fairly easily. But the rest was ships and metal goods—and Finland had few materials, plants, or skilled workers in the field.

However well disguised, this demand proved a blessing. The Finns developed their first metals industry. The reparations were paid in full by 1952.

Not such a blessing is reorientation of trade toward the east. For her exports to Russia, Finland wants in return coal, gasoline, and oil. Russia would rather send automobiles, vegetables, crab meat, and caviar.

Annual trade negotiations are off again,

PHOTOGRAPHS BY JERRY WALLER

Winter Puts a Nation on Skis

SKIING is the Finnish national sport. Children ski to school, even glide over housetops as in the picture above. An annual winter vacation is scheduled so that all the family can enjoy a skiing holiday. During the Winter War (1939-40) ski-borne Finnish troops outmaneuvered and outfought invading Russians in the forests of Karelia, but were finally overpowered.

Arts are an important part of Finnish life. A member of a women's homecraft organization (left) works at her loom. From native handcrafts have developed world-renowned rugs, glass, ceramics, and pottery. Finnish artistry is also evident in modern architecture and sculpture.

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